Power Outage Emergencies

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Power Outage Emergencies

Types of Outages

- 3 Basic Categories
  - Voltage Reduction (aka Brownout)
  - Rotating/Rolling Blackout
  - System Blackout

Power Outage Emergencies

Examples

- Voltage Reduction
  - July 27, 2005 – Northern Virginia and Maryland
- Rotating / Rolling Blackout
  - 2000 – 2001 – California
  - January 19, 1994 – East Coast
- System Blackout
  - August 14, 2003 - Northeast

Power Outage Emergencies

Voltage Reduction

- Temporary 5% Voltage Reduction
  - 120 VAC → 114 VAC
- Generally used during periods of very high loads to address localized operating issues where reactive power (VAR) support is marginal.
- Can defer/eliminate the need to use more aggressive load management options.

Power Outage Emergencies

Voltage Reduction

- July 27, 2005
  - Extreme heat.
  - High power flows to the Northeast.
  - Significant transmission system burden in Southern Maryland – Northern Virginia.
  - Reduced voltage in affected areas by 5% to provide relief.
  - Avoided the need to initiate rotating blackouts.

Power Outage Emergencies

Rotating Blackout

- Used to manage situations where load is expected to exceed available generation.
- Controlled. Generally lasting 15-30 minutes.
- Surgical application – avoid critical loads.
- Limited to a finite number of customers at a given time.
- System remains intact.

Power Outage Emergencies

Rotating Blackout

- 2000 - 2001 – California
  - Local generation off-line due to maintenance.
  - Transmission constraints limited access to power from the North.
- January 19, 1994 – East Coast
  - Extreme cold.
  - Limited access to power from the South due to widespread cold conditions.

Power Outage Emergencies

System Blackout

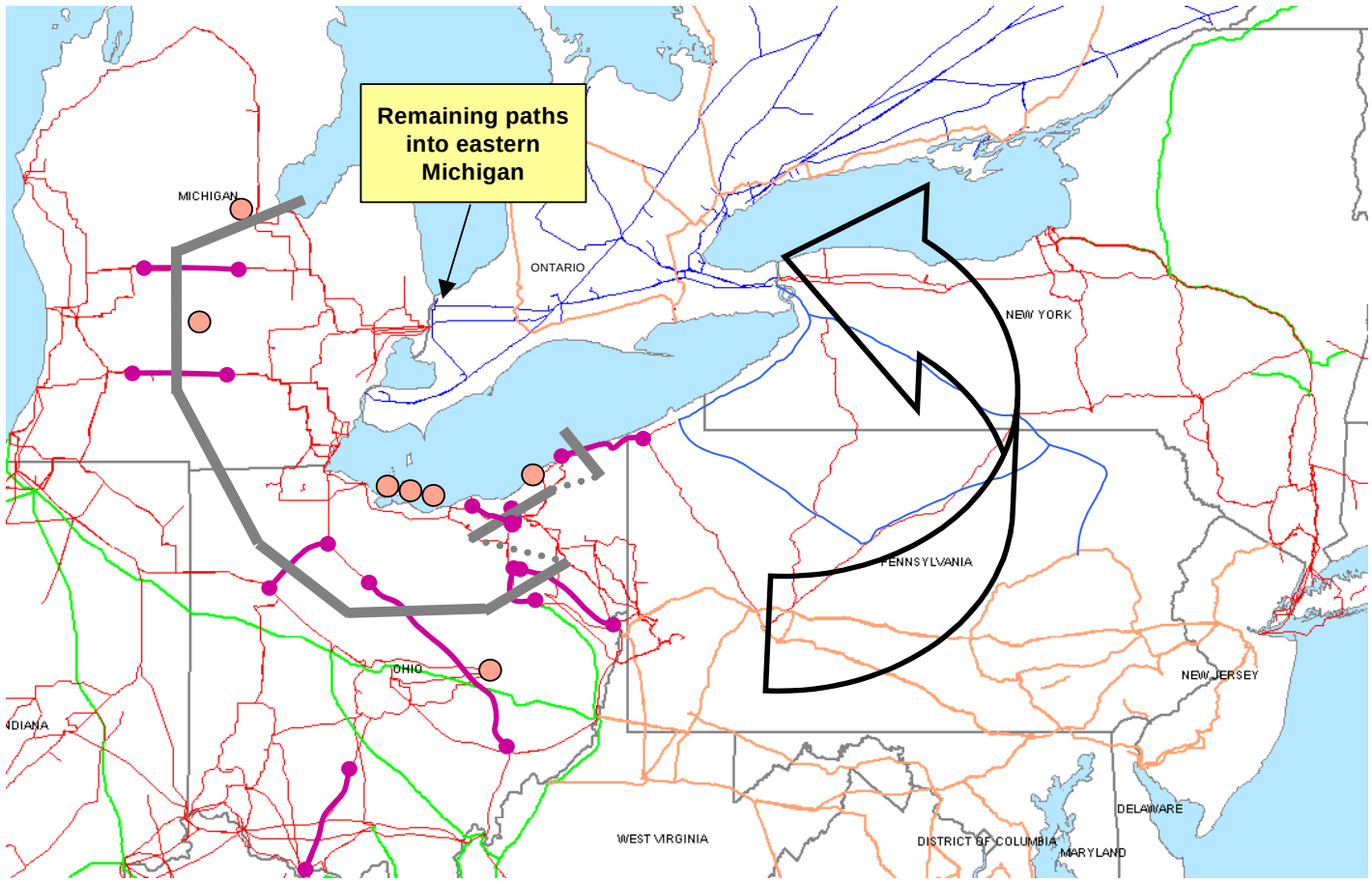
- Initiated by a convergence of multiple contingencies.
- Uncontrolled.
- Affects a wide area and/or many customers.
- May have island(s) where generation = load.
- Generation trips off-line to protect itself.

Northeast Blackout
August 14, 2003

- Rapid Blackout Sequence commenced at 4:05 pm EDT. Conditions ripened much earlier.
- Blackout actions essentially completed by 4:13 pm EDT
- Impact:
  - Approx. 50 Million People
  - 8 States and 2 Provinces
  - Est. costs: $4 - 10 Billion (in US only)
  - 61,800 Megawatts of Generation – 531 units at 263 sites tripped off-line
  - 404 transmission lines operated

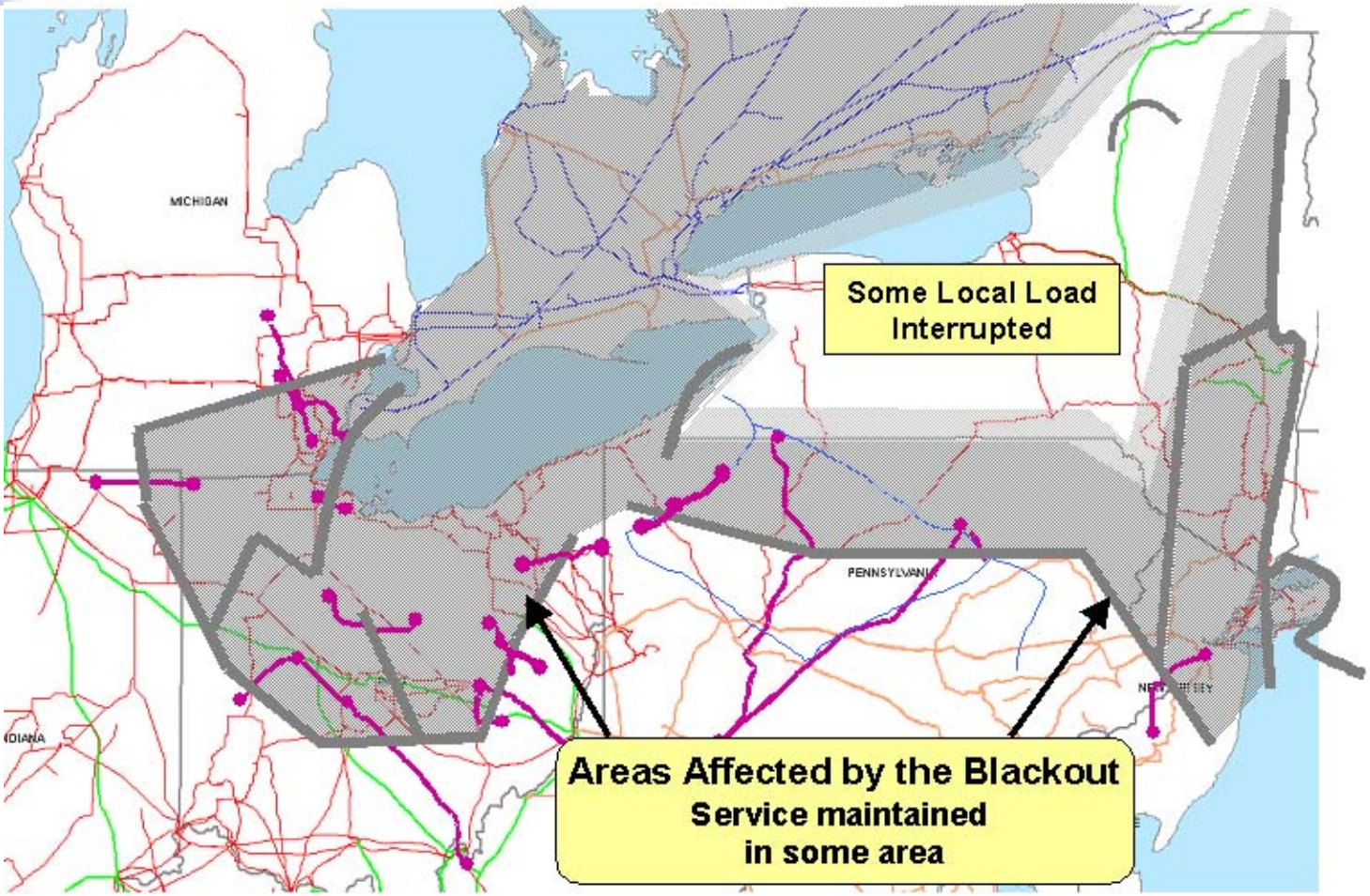
Northeast Blackout

August 14, 2003



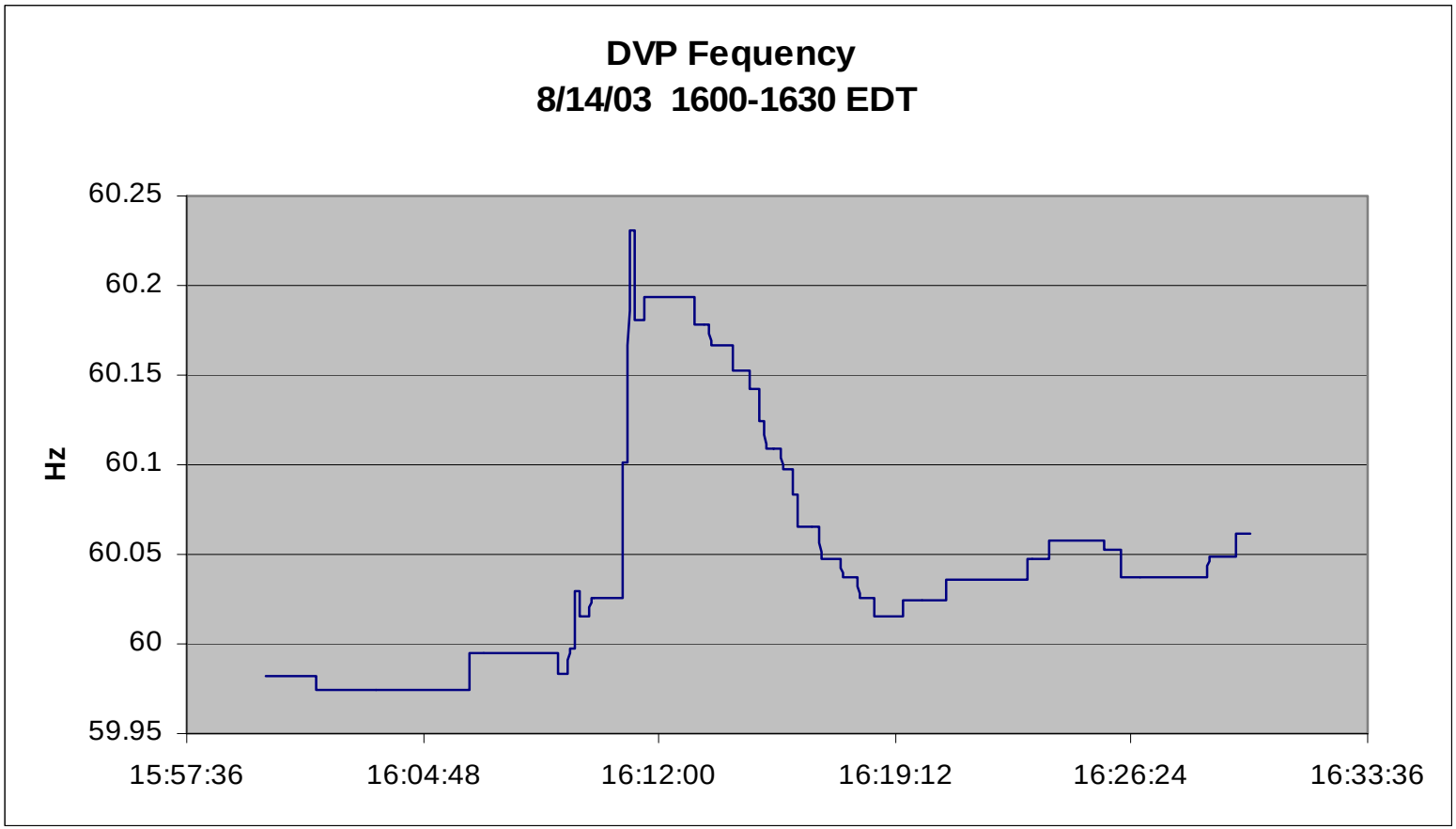
Northeast Blackout

August 14, 2003



Northeast Blackout

What We Saw in Virginia



Northeast Blackout

Why?

- Root Causes
  - Seven violations of NERC reliability standards by entities in Ohio where the Blackout originated.
  - Inadequate long-term planning studies to address inadequacies of the grid.
  - Inadequate Situational Awareness.
  - Inadequate Vegetation Management
  - Inadequate Real-Time Tools and Communications

Northeast Blackout
Industry Response

- Dominion's Response:
  - NERC Readiness Audit
  - Re-validate Protection Equipment Settings
  - Re-affirm Operator Authority
  - Wide-Area View
  - Dispatcher Training Simulator (DTS)
  - Learning Management System (LMS)

Northeast Blackout
Industry Response

- Dominion's Response:
  - Emergency Planning
    - System Restoration
    - Load Curtailment
    - Voltage Reduction
    - Cyber Security
    - Physical Security

Northeast Blackout
Industry Response

- Regional Efforts (PJM)
  - Planning
  - Operations
  - Emergency Exercises
    - March 14-15, 2006 – System Restoration
    - May 16, 2006 – Load Curtailment
- Other
  - Hotline / Satellite Telephones
  - NERC ES-ISAC Support

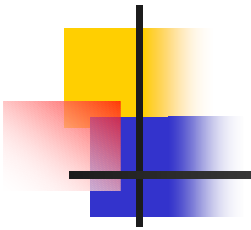
Power Outage Emergencies

Public Messages

- Dominion and PJM
  - Day-Ahead Studies
  - Messages
    - Alert
    - Warning
    - Action

Power Outage Emergencies

Questions?



Thank You